REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 1 by incorporating therein the subject matter of each of claims 2 and 3, and have further amended claim 1 to correctly set forth the dimensions of the oxygen permeation coefficient. In view of amendment of the dimensions of the oxygen permeation coefficient in claim 1, it is respectfully submitted that rejection of claims 1-19 under the second paragraph of 35 U.S.C. §112, set forth in Item 1 on page 2 of the Office Action mailed April 14, 2006, is moot.

In light of incorporation of subject matter of claims 2 and 3 into claim 1, Applicants have cancelled claims 2 and 3 without prejudice or disclaimer. Moreover, in light of canceling of claims 2 and 3, Applicants are also canceling claims 13-15 and 17-19 without prejudice or disclaimer.

Moreover, Applicants are adding new claims 20-22 to the application. Claims 20 and 21, dependent respectively on claims 1 and 20, define a thickness of the skin layer, consistent with the description on page 15, lines 17-19, of Applicants' specification. Claim 22, dependent on claim 1, recites that the auxiliary layer is disposed so that internal pressure in the tire is retained by the auxiliary layer when pin holes or cracks are formed in the skin layer. Note, for example, page 17, lines 20-22, of Applicants' specification.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed April 14,

2006, that is, the teachings of the U.S. Patents to Boon, et al, No. 5,036,113, to Uchida, et al, No. 6,569,533, to Lin, et al, No. 5,040,583, and to Kaido, et al, No. 6,136,123, under the provisions of 35 U.S.C. §102 and 35 U.S.C. §103.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a pneumatic tire as in the present claims, having the specified skin layer formed by curing a polyurethane resin composition including a compound having active hydrogen atoms and an organic polyisocyanate compound, the skin layer having at least 20% by weight or more of a skeleton structure represented by the formula (1) and having a specified oxygen permeation coefficient, and wherein the pneumatic tire also includes an auxiliary layer, having a thickness in a range of 50-500 μm, which is disposed adjacent to the skin layer and includes an elastomer having an oxygen permeation coefficient at 23°C under a relative humidity of 60% of 5,000 ml·mm/m^2·day·MPa or smaller. See claim 1.

In particular, as will be shown in the following, it is respectfully submitted that the applied references do not disclose, nor would have suggested, such tire having both the skin layer as in the present claims and the specified auxiliary layer, having the recited thickness, and providing advantages with respect to, e.g., avoiding gas leakage.

Furthermore, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such pneumatic tire as in the present claims, having features as discussed previously in connection with claim 1, and, moreover, further including (but not limited to) thicknesses of the

skin layer as in claims 20 and 21, and disposition of the auxiliary layer as in claim 22; and/or wherein the compound having active hydrogen atoms is a compound having an odd number of atoms connecting the active hydrogen atoms, with the organic polyisocyanate compound being a compound having an odd number of atoms connecting isocyanate groups (see claim 4); and/or recited materials for the compound having active hydrogen atoms, as in claims 5-9 and 16; and/or wherein the organic polyisocyanate compound is a compound selected from those set forth in claims 10-12.

The present invention is directed to a pneumatic tire, having an improved property for retention of internal pressure in the tire, yet having a decreased weight.

As a method for retaining internal pressure of a tire, the method of disposing a barrier layer to the air as an inner liner of the tire has been proposed. Specifically, a rubber composition containing butyl rubber or halogenated butyl rubber has been proposed as the main material of the inner liner. However, this type of inner liner, which must be relatively thick, disadvantageously increases the weight of the tire.

It has also been proposed to use a material having a smaller permeation of air than that of butyl or halogenerated butyl rubber, as a liner, e.g., using a layer composed of an ethylene-vinyl alcohol copolymer. However, this copolymer has a relatively low melting point, and a uniform barrier layer cannot be insured, due to melting of the copolymer during vulcanization of the tire. If has also been proposed to use crosslinked polyvinyl alcohol or a crosslinked ethylene-vinyl alcohol copolymer as the barrier layer; however, these materials require an adhesive for attaching a film thereof, disadvantageously increasing cost.

Thus, it is still desired to provide a pneumatic tire having a skin layer which can retain internal pressure, achieve a decrease in weight of the tire, avoid increased cost and increased processing steps in the manufacture of the tire, and which has excellent durability and achieves quiet driving.

Against this background, and as a result of intensive studies by the present inventors, Applicants have found specific materials for the skin layer, and have also found that by providing an auxiliary layer of a specified material, and having a specified thickness, objectives according to the present invention are achieved. That is, a tire which retains internal pressure and does not require unduly increased weight, avoids the needs for an adhesive and thus reduces processing complexity, and has excellent durability and achieves quiet driving, is obtained. Applicants have found that by forming the skin layer by curing a specified polyurethane composition as in the present claims, and by including in the pneumatic tire the auxiliary layer, having a thickness in the range of 50-500 μm, this auxiliary layer being disposed adjacent to the skin layer and including an elastomer having an oxygen permeation coefficient at 23°C under a relative humidity of 60% of 5,000 ml·mm/m^2·day·MPa or smaller, objectives of the present invention are achieved. Specifically, through use of the auxiliary layer, internal pressure of the tire can be retained even when pin holes or cracks are formed in the skin layer. Note, especially, claim 22. Moreover, the use of the auxiliary layer as in the present claims, cleavage of the layers is suppressed and the skin layer remains without changes at almost entire portions of the surface containing the air and continuously exhibits the function of retaining the internal pressure.

As for advantages achieved according to the present invention, note the paragraph bridging pages 17 and 18, and the second full paragraph on page 18, of Applicants' specification.

Boon, et al, discloses rubber tires having inner liners, and compositions used in the coating of such inner layers. The rubber tire includes a cured rubber substrate; and a radiation cured elastomeric coating bonded to at least one surface of the rubber substrate, the elastomeric coating being a low oxygen permeability reaction product of an end-capped prepolymer which is a reaction product described in column 2, lines 31-52 of Boon, et al, together with a monofunctional addition polymerizable reactive diluent monomer or mixture thereof, described in column 2, lines 53-61, of Boon, et al. This patent discloses that a cured rubber inner liner 18 (see Fig. 1) may be adhered to the inner surface of tire carcass 12, the inner liner being made of a material (e.g., natural rubber, styrene-butadiene rubber, polybutadiene rubber or blends thereof) which may be either sulfur or peroxide cured; and that a thin air barrier coating 20 of the above-referred-to radiation cured elastomeric coating is adhered to inner liner 18, this coating being typically very thin, e.g., about 1 to about 20 mils. See column 3, line 60 to column 4, line 19. Note also column 5, lines 12-21. See further, column 10, lines 12-16 and 29-34.

It is noted that Boon, et al, discloses an inner liner made of various rubber materials, "which protects the carcass plies". It is respectfully submitted that the teachings of Boon, et al, including the teaching of function of the cured rubber inner liner, would have neither taught nor would have suggested the presently claimed subject matter, including, inter alia, the auxiliary layer and function thereof, and

thickness thereof, as in the present claims.

The contention by the Examiner that inner liner 18 "would be expected to meet the claims requirements" of claims 2 and 3, is respectfully traversed. It is respectfully submitted that the Examiner has provided no evidence or reasoning supporting this conclusion that the inner liner layer of Boon, et al, "would be expected" to meet the claimed requirements. Especially in view of the function of the inner liner layer of Boon, et al, as compared with the function of the auxiliary layer of the present claims, it is respectfully submitted that the Examiner has not established that the inner liner layer of Boon, et al, would meet the claimed recitations in connection with the auxiliary layer of the present claims. In this regard, it is respectfully submitted that the conclusion by the Examiner of "expected to meet" does not establish anticipation, either evidence or reasoning being necessary for establishing anticipation. See In re McKellin, 188 USPQ 428 (CCPA 1976).

Uchida, et al, discloses a gas barrier polyurethane resin which is useful as a film, a sheet, or a molding material having gas barrier properties against water vapor, oxygen, aromatics and others, and in adhesion to a base film, the gas barrier polyurethane resin having a total concentration of urethane group and urea group which is not less than 15% by weight. The resin has oxygen permeability, at a thickness of 25 μm, of 50 $ml/m^2 \cdot atm \cdot day$ or less, and has a low humidity-dependency. See column 1, lines 6-10, and column 2, lines 49-55. See also column 3, lines 6-8, and column 4, lines 48 and 49. See, further, column 7, lines 19-27; column 8, lines 1-8; and column 10, lines 27-31. This patent further discloses that the composition, which does not include a chlorine-containing compound, does

not contaminate the environment and can be utilized in a variety of fields, such as the field of packaging materials or molding materials. Note column 11, lines 48-58.

It is noted that Uchida, et al, discloses a gas barrier polyurethane resin film having gas barrier properties, and useful, e.g., in the field of packaging or molding material. It is respectfully submitted that Uchida, et al, does not disclose, nor would have suggested, use of the material described therein under the relatively harsh conditions of, e.g., a pneumatic tire as in the present claims. Moreover, it is respectfully submitted that this reference does not disclose, nor would have suggested, a pneumatic tire, having both a skin layer and an auxiliary layer as in the present claims, particularly having a thickness of the auxiliary layer (and a thickness of the skin layer as in claims 20 and 21), and advantages thereof.

It is respectfully submitted that the additional teachings of either and/or both of Lin, et al, and of Kaido, et al, would not have rectified the deficiencies of Uchida, et al, such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Lin, et al, discloses an inner liner which is an innermost layer of a tire structure for maintaining the internal air pressure in such a tire, the inner liner being an integral composite structure comprising at least one layer of a thin film of a non-elastomeric barrier material that (i) has an air permeability of no more than 0.05 Barrer at 23°C, (ii) is thermally stable to withstand the conditions required for the vulcanization of the rubber layer, and (iii) has adequate flexibility and extensibility, each barrier material layer being sandwiched between two layers of an elastomer to form a composite structure which is adhered to the rubber layer of the tire. See

column 1, lines 10-13, and column 2, lines 3-19. See also column 2, lines 23-30. This patent further discloses use of a tie layer material between the ethylene-vinyl alcohol copolymer barrier layer and the rubber surface layer, this tie layer being a blend of maleic anhydride grafted polypropylene and styrene-isoprene or styrene-butadiene thermoplastic elastomer or the hydrogenated products thereof. See column 4, lines 39-43. This patent further discloses that the materials used for the surface (skin) layers of the inner liner can be any elastomer including thermoplastic elastomers with appropriate compounding. See column 4, lines 60-65.

Kaido, et al, discloses a process for producing a pneumatic tire using a thermoplastic film for an inner liner of the tire, the process including applying to at least a part of the joining portion of the thermoplastic film or tire member facing the thermoplastic film, a tackifier-adhesive composition containing a polymer component having an absolute value of the difference of the critical surface tension with the rubber component of the tire member and the polymer component of the surface layer of the thermoplastic film of not more than 6 mN/m. See column 2, lines 18-30. Note also, column 3, lines 3-5 and 36-40.

Initially, it is respectfully submitted that the teachings of Uchida, et al, would not have been properly combinable with the teachings of either and/or both of Lin, et al, and Kaido, et al. In this regard, note that Uchida, et al, is directed to a polyurethane resin gas barrier having gas barrier properties against water vapor, oxygen, aromatics and others, used, for example, in the field of packaging or molding materials. It is respectfully submitted that one of ordinary skill in the art concerned within Uchida, et al, addressing the problem of avoiding contamination of

the environment due to chlorides in the film, would not have looked to the pneumatic tires of Lin, et al, and Kaido, et al, addressing different problems than those of Uchida, et al. In other words, it is respectfully submitted that Uchida, et al, is non-analogous art, with respect to Lin, et al, and Kaido, et al.

Moroever, it is respectfully submitted that the Examiner had pointed to no proper motivation for combining the teachings of Uchida, et al, with the teachings of either and/or both of Lin, et al, and of Kaido, et al. Noting especially the particularly severe conditions involved in use of tires, as compared with, e.g., molding or packaging materials as discussed in Uchida, et al, it is respectfully submitted that there would have been no motivation for looking to the teaching of Lin, et al, and/or Kaido, et al, in connection with the polyurethane resin of Uchida, et al.

In any event, even assuming, arguendo, that the teachings of Lin, et al, and/or Kaido, et al, were properly combinable with the teachings of Uchida, et al, it is respectfully submitted that such combined teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including, inter alia, the auxiliary layer, having the specified thickness, which includes an elastomer having the recited oxygen permeation coefficient, as in the present claims, and advantages thereof, especially in connection with retaining internal pressure in the tire (note, especially, claim 22).

The contention by the Examiner in the paragraph bridging pages 4 and 5 of the Office Action mailed April 14, 2006, that Lin, et al, and Kaido, et al, "provide evidence that those having ordinary skill in the tire art have contemplated use of a wide variety of gas barrier film materials as a barrier layered for a tire", is noted. It is

respectfully submitted, however, that the test under 35 U.S.C. §103 is not whether the teachings of the references show contemplated use of a wide variety of gas barrier film material, but rather whether the combined teachings of the references would have led one to the specific material as in the present claims. Emphasizing that Uchida, et al, does not teach, nor would have suggested, use of the material described therein under relatively harsh use conditions such as occur in use of a pneumatic tire; and, moreover, noting that Lin, et al, and/or Kaido, et al, would not have led one of ordinary skill in the art to polyurethane resins as in Uchida, et al, it is respectfully submitted that the Examiner has not established a proper basis for a conclusion of obviousness from the combined teachings of the applied references. It is respectfully submitted that "contemplated use of a wide variety of gas barrier film materials" in the secondary references, even if correct, would not have established obviousness in connection with use of the gas barrier polyurethane resin of Uchida, et al, under the relatively harsh conditions occurring in use of pneumatic tires.

The contention by the Examiner in connection with claims 2 and 3, set forth in the first full paragraph on page 5 of the Office Action mailed April 14, 2006, is noted. It is respectfully submitted that Kaido, et al, discloses that the material of the rubber layer to which the air permeation preventive layer is laminated is not particularly limited, and that any rubber material which has been generally used in the past as a rubber material for tires may be used. Examples of such a rubber are rubber compositions described in column 4, lines 44-51. It is respectfully submitted that such layers would not have disclosed, nor would have suggested, the auxiliary layer, much less the thickness thereof, as in all the present claims.

Furthermore, Lin, et al, discloses a "tie layer" which would be similar to an "auxiliary layer" as in the present claims. However, Lin, et al, discloses use of a thermoplastic elastomer, Kraton 1117, for the tie layer. Kraton 1117 is a polystyrene-polyisoprene-polystyrene thermoplastic elastomer sold by the Shell Company. The oxygen permeation coefficient of the polystyrene block is 1,362 $ml \cdot mm/m^2 \cdot day \cdot MPa$ and that of the polyisoprene block is 12,762 $ml \cdot mm/m^2 \cdot day \cdot MPa$. As the styrene content of the Kraton 1117 is 17% by mass, and oxygen permeation coefficient of Kraton 1117 must be much larger than the upper limit of 5,000 for the auxiliary layer, as in the present claims.

in view of the foregoing, it is respectfully submitted that even taking the teachings of Lin, et al, and/or Kaido, et al, together with the teachings of Uchida, et al, such teachings would have neither disclosed nor would have suggested the presently claimed subject matter including, inter alia, the auxiliary layer and thickness thereof; and/or other features of the present invention as discussed in the foregoing, and advantages of the present invention.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

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(Case No. 396.43380X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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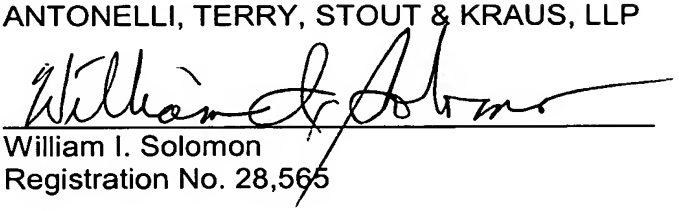

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